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1. G. M. Adamson
2. C. L. Wolfe
3. K. Z. Morgan
4. F. Western
5. R. S. Thackeray
6. J. C. Hart
7. T. H. J. Burnett
8. W. H. Ray
9. R. L. Clark
10. O. D. Teague
11. C. Files
12. C. Files
13. R. Files

July 8, 1948

To: G. M. Adamson

From: R. L. Clark

Subject: Air Contamination in Preparation of U-Al Alloy Using Natural Uranium

In compliance with your request for information regarding airborne activity hazards arising from the preparation of uranium - aluminum alloys in the 101-B Building, the following report is submitted.

During the period of 17 June 1948 to 28 June 1948, a total of 16 air samples was taken during the preparation of these alloys, using natural uranium. Special care was given to the counting of these samples by personnel in the counting room, and the probable error reduced to insignificance on key samples. Results on these samples and the conditions under which they were taken are shown in tabular form on the last two pages.

The tolerance value used in the computations was 3.1×10^{-11} microcuries of long lived alpha activity per cubic centimeter of air sampled as recommended by K. Z. Morgan in a report dated 14 January 1946. In connection with this problem, it must be stressed that the objective is to avoid any exposure, not merely to stay within tolerable limits. With this in mind, the most significant conclusion drawn from the results is that appreciable long-lived activity is present under all conditions tested, and it is recommended that personnel spend a minimum amount of time in the room during the process as it now stands.

Examination of the results shows that 3 samples were collected when above tolerance activity was present. A comparison of samples A-1 and B-1 indicates that the foil-wrapping of the powder before addition makes little difference in the amount of activity given off. The results obtained on samples A-1 and D-1 (which represent an attempt to duplicate results) show that the addition of the oxide as a loose powder with the hood off is definitely not a safe procedure. Comparing these samples again to sample C-2 shows that the hood being on renders the powder addition safe. Comparing samples B-2 and F-1 shows that the hood being on is necessary and sufficient (for safety) in the addition of the foil-wrapped powder.

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Examination of the results on samples A-2, B-2, C-3, D-2, and E-2 shows that some activity is driven off during the cooking or post-melting stage.

The results on samples A-3, B-3, C-4, D-3, and F-3 show that the general room activity does not reach dangerous levels under any of the conditions tested. By general room activity, it is meant the activity at approximately 5 feet from the furnace through all steps of the process.

Sample C-1 shows that some activity is liberated during remelting of alloy pigs and that the hood should be on during this operation.

Sample G shows that considerable activity is being liberated at the top of the stack. This activity may become a definite hazard in case materials having a greater specific activity than natural uranium are used in the processes.

To briefly recapitulate, some activity is given off in all steps of the process. The present hood and duct system appears to afford adequate protection during all steps. The foil-wrapping of the powder is no great improvement in the addition step so far as the resultant activity is concerned. Considerable activity is being liberated at the top of the stack. At the present time this activity is not of a hazardous level, but the use of some other material having a higher specific activity than that in use during these tests may cause it to be above tolerance. This last statement applies as well to the samples taken inside the building.

R. L. Clark

R. L. Clark

RLC:cs

Date	Sample No.	Time	μc Sample	% Probable Error	μc/cc	% Tol.	Discussion Reference Number
6-17-48	1	30	142×10^{-6}	< 2	3.94×10^{-11}	127	A-1
	2	30	18×10^{-6}	< 5	$.5 \times 10^{-11}$	16	A-2
	3	60	27.9×10^{-6}	< 3	$.38 \times 10^{-11}$	12	A-3
	4	30	141×10^{-6}	< 2	3.91×10^{-11}	126	B-1
	5	30	19.8×10^{-6}	< 5	$.55 \times 10^{-11}$	17	B-2
	6	60	23×10^{-6}	< 5	$.32 \times 10^{-11}$	10	B-3
6-18-48	1	20	8×10^{-6}	< 3	$.33 \times 10^{-11}$	10	C-1
	2	30	8×10^{-6}	< 3	$.22 \times 10^{-11}$	7	C-2
	3	30	14×10^{-6}	< 3	$.39 \times 10^{-11}$	12	C-3
	4	50	2×10^{-6}	< 3	$.03 \times 10^{-11}$	.9	C-4
6-21-48	1	30	132×10^{-6}	< 3	3.66×10^{-11}	118	D-1
	2	25	6×10^{-6}	-	$.2 \times 10^{-11}$	6	D-2
	3	55	5×10^{-6}	-	$.07 \times 10^{-11}$	2	D-3
6-22-48	8	30	70×10^{-6}	< 2	1.94×10^{-11}	62	E-1
	9	30	5×10^{-6}	< 3	$.14 \times 10^{-11}$	4	E-2
6-28-48	1	33	11×10^{-6}	< 2	$.27 \times 10^{-11}$	9	F-1
	2	28	0	-	----------	--	F-2
	3	63	9×10^{-6}	< 2	$.12 \times 10^{-11}$	4	F-3
7-1-48	1	30	80×10^{-6}	< 3	2.2×10^{-11}	71	G

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Sample Reference Number	Conditions
A-1	Tube ~1 ft. above furnace, hood off, during addition and melting of powder oxide.
A-2	Tube in same position, hood on, during cooking and stirring steps.
A-3	Tube ~ 5 ft. south of furnace during both of above steps.
B-1	Same as A-1, with powder wrapped in aluminum foil before addition.
B-2	Same as A-2.
B-3	Same as A-3.
C-1	Tube ~1 ft. above furnace, hood off, during remelting of pig alloy.
C-2	Same as A-1, except hood was on.
C-3	Same as A-2, except hood was off.
C-4	Tube ~5 ft. south of furnace during both of above steps.
D-1	Same as A-1.
D-2	Same as A-2.
D-3	Same as A-3.
E-1	Same as B-1.
E-2	Same as B-2.
F-1	Same as B-1, except hood was on.
F-2	Same as B-2 (A-2).
F-3	Same as B-3 (A-3) during both of above steps.
G	Tube positioned in center of exit end of hood duct (on roof of bldg.)

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